Department of Decision and Information Sciences

BZAN 6353 Research Design for Problems in Business Analytics
Course Information
Fall 2020

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Office hours: Monday 9:00 AM to noon, Tuesday - 4:00-5:00pm, and/or by appointment

Required Text: Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora, 2nd Edition, 2015.

Course Description:

This course covers the strategy to translate a real business problem into research practices. Students will learn the principles of conducting empirical research with emphasis on learning how to ask relevant business research questions. They will learn to apply best research practices for formulating relevant hypotheses, collecting data, interpreting results, and proposing concrete recommendations for decision making. They will be trained on how to leverage the data as the evidence that supports or disqualifies their beliefs and to avoid the pitfalls of common data collection methods.

Course Contents

The course consists of five modules which deal with different aspects of research design for solving business problems using techniques in data analytics. Each module covers a set of core concepts which are used to develop frameworks to solve problems of conducting research in business analytics to solve specific problems the businesses and corporations encounter. Each module also covers several application exercises where students use the frameworks developed in the modules to address specific problems in research design. The structure and contents of each module is discussed below.

Module 1: Research Methods: Conceptual Foundations

This module introduces students to the fundamentals of conducting research in business analytics. Students are introduced to ideas of rigor in research, to recognize the trade-offs between rigor and relevance, and methods of optimizing rigor without sacrificing relevance. They are introduced to the idea of explanatory research models and what these models attempt to achieve. In particular, they develop frameworks to understand the nature and extent of relationships and associations between factors of interest and phenomena whose outcomes they seek to explain. They learn how these outcomes as well as factors of interest can be converted into constructs which can then be measured and translated into variables.

Students will build on these conceptual frameworks and learn to formulate specific hypotheses that related to business problems that can be solved by invoking techniques in business analytics. They will learn about the criteria for formulating rigorous problem statements that pitfalls of loosely defined and/or imprecisely formulated hypotheses.

In the Application session they will apply these frameworks to develop constructs, operationalize constructs with variables, and devise measurement systems for variables. They will apply these techniques to solve commonly occurring research problems in business analytics in specific market contexts.

Module 2: Causal Inference

This module introduces students to the idea of cause and effect and how inference can be supported by research design. Students will learn about the idea of randomness and how randomization is to be achieve representativeness.

They will learn about rules of categorization and the role of variance in data. They will learn about sampling and what rigorous sampling is meant to achieve. They will be introduced both probabilistic and non-probabilistic sampling techniques.

In the Application Session, students will apply sampling techniques to solve specific business analytics problems. They will learn to apply analysis of variance and related techniques to solve problems of inference from populations characterized by heterogeneity of data sources.

Module 3: Measurement

In this module two key concepts in empirical research – especially as they pertain to business analytics – are introduced. These are Reliability and Validity. Students learn about the role of reliability and validity in interpreting data as well as in the design of research that addresses specific problems. They will learn about threats to reliability as well as measures of reliability. They will also learn about different kinds of validity including construct validity, content validity, criterion validity and how each influences both the design of research and the interpretation of results. Students will use the conceptual frameworks developed in the module to design research surveys; they will assess the extent to which their survey instruments could face the twin threats of lack of reliability and poor validity.

In the Application session students work on applying the conceptual frameworks to solving specific business problems.

Module 4: Research Design

In this module students will be exposed to principles of research design. They will learn conceptual frameworks of experimental research design as well as those of quasi-experimental research design. They will learn how the design informs the extent to which information signals are enhanced (signal enhancing research designs) and noise is reduced (noise reducing research designs).

In the Application session they will learn to apply the appropriate research design given the structure of the business analytics problem and the nature of the data sources. They will work on a variety of design problems set in commonly occurring business contexts.

Module 5: Advanced Concepts in Causal Inference

This module covers the building and analysis of models of effects. Such models of effects require an understanding of how causal inference manifests itself and how it can be identified. The module also covers multivariate models and how these can be employed to measure the nature and extent of effect sizes or the extent of causal inference. This module will build on the ideas developed in previous modules as well expose students advanced techniques in identifying and measuring the marginal impact of one or more factors on an outcome of interest.

Teaching Methods:

1. Online Synchronous Sessions: Important material from the text and outside sources will be covered in class. Students should attend these sessions and participate in the proceedings. Discussion is encouraged and from time to time we may review, analyze, or discuss outside material relevant to the topics being covered.

2. Online Asynchronous Sessions: Important concepts, conceptual frameworks and discussions of tools and techniques will be made available to students via these sessions. Students are required to make themselves fully familiar with the contents covered in these sessions. We will switch between synchronous and asynchronous sessions as needed and in response to contingencies and situations that might arise.

3. Assignments: Tasks related to the conceptual frameworks learned in class will be assigned to groups of students. These assignments may consist both of work done 'in class' during the synchronous sessions as well as work that may be assigned as homework (to groups and/or individual students).

4. <u>Exams</u>: Exams/Quizzes will be open book/note and will test material that is covered in the course. The final exam will be cumulative to the extent that it will include topics that are covered earlier in the course.

NOTES ONLINE: You will have access to all material via the **Blackboard Learn** application.
- The lecture slides will be available in the <u>CLASS NOTES</u> section of the class web site. The slides posted within 24 hours prior to each class session. But, on a few rare occasions, I might make minor changes to them **just in time for our class**. Of course, I will make you aware of these changes in class.

5. **Announcements** regarding the class such as schedule changes, assignments, projects, and so on will be made in class during the synchronous sessions as well as on the web at the <u>Announcements</u> page. If you do not attend the synchronous sessions, then please be sure to check if there are announcements.

6. **Contacting the Professor:** You can reach me by telephone or email. If you try to reach me, and you are unable to do so, then leave a message for me. I will try to get back to you within 48 hours.

7. **Teaching Assistant (TA):** As we cover this course, it is my intention to have the support of a TA. The details will be announced later.

8. **Grading:**

   1. Quiz 1: 15% of final grade
   2. Quiz 2: 15% of final grade
   3. Assignments: 30% of final grade.
   4. Exam: 40% of final grade

   Final course letter grade follows the numeric-letter grade system used here at University of Houston.

Course Policies:

<u>Missed Classes</u>: The student is responsible for obtaining material, which may have been distributed through a variety of different methods. This can be done through contacting a classmate or by contacting the instructor during his office hours. Missed or late exams, quizzes cannot be made up under any circumstances, unless an official excuse is provided. **Any uncoordinated, unexcused missed quizzes, exams or other evaluation exercise will result in a score of 0 for that evaluation exercise.**

Assignments: The delivery schedule of completed assignments, and the mode of delivery will be specified ahead of time. You are required to be a part of a group <u>with about 5 or 6 other students</u>. All students that have enrolled in the course have been assigned to groups using a random number generating process. You will work with your group members on the assignments. The instructor may assign additional members to a group, remove members from a group, or <u>change the composition of groups</u> in response to contingencies that arise and for advancing the learning goals of students in the context of situations that may necessitate such interventions.

Toward the end of the semester, you will have an opportunity to conduct a peer evaluation of what each member of your group contributed to the work done. I will use the score on these evaluations in an appropriate weighted fashion to determine each group member's score for assignments.

<u>Academic Dishonesty</u>: Plagiarism and cheating are serious offenses and may be punished by failure on exam, paper or project; failure in course; and or expulsion from the University. For more information, refer to the "Academic Dishonesty" policy in the University's Catalog. The University of Houston Academic Honesty Policy is strictly enforced by the C. T. Bauer College of Business. No violations of this policy will be tolerated in this course. A discussion of the policy is included in the University of Houston Student Handbook, http://www.uh.edu/dos/hdbk/acad/achonpol.html. Students are expected to be familiar with this policy.

<u>Need for Assistance</u>: If you have any condition, such as a physical or learning disability, which will make it difficult for you to carry out the work as outlined in this document, or which will require academic accommodations, please

notify me as soon as possible. I will recommend that you contact the Center for Students with Disabilities. The contact person is Justin Dart in the CSD building #568, room 110. The numbers for the CSD office are Ph: 713-743-5400; TDD: 713-749-1527; Fax: 713-743-5396 or email: uhcsd@uh.edu.

Posting of Grades: Your scores will be posted on blackboard and where deemed necessary, they will be reported via other methods.

Tentative Lecture Outline

This outline is tentative. It may change in the event of unforeseen class disruptions. As such, it could be modified as time goes by.

No	Date	Topic	Reading / Reference Material
1	27-Aug	*Module 1: Research Methods: Conceptual Foundations* What is rigor? What are the limits of phenomenology? Explanatory Research and Models Constructs, Measurements, and Variables Relationships and Associations	Instructor's Notes / Teaching Excerpts. **Optional:** Chapter 1: Theory-Based Data Analysis for the Social Sciences 2nd Edition, by Carol S. Aneshensel
2	3-Sep	*Application Exercises* Working with constructs Operationalizing variables Measurement and Measurement Models and Errors Working with Associations, Relationships and Explanatory models	Instructor's Notes / Teaching Excerpts
		NO CLASS LABOR DAY WEEK	
3	17-Sep	*Formulating Problems & Hypotheses* Criteria of problems and problem statements Hypotheses The Multivariate Approach: Problems and Definitions	Instructor's Notes [Based on Chapter 2: Foundations of Behavioral Research, 4th Edition, Kerlinger]
		Module 2: Causal Inference Sampling and Randomness Randomness, Randomization, Representativeness Non-Probabilistic Sampling	Instructor's Notes [Based on Chapter 8: Foundations of Behavioral Research, 4th Edition, Kerlinger] **Optional Reading:** Chapter 4, Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora
		Quiz - 1	
4	24-Sep	*Hypothesis Testing & Analysis of Variance* Hypothesis Testing Frameworks Analysis of Variance	Instructor's Notes [Based on Chapter 13: Foundations of Behavioral Research, 4th Edition, Kerlinger]

No	Date	Topic	Reading / Reference Material
5	1-Oct	*Application Exercises* Applying Analysis of Variance and Related Methods to business problem contexts Working with Hypotheses, and Random Samples	Instructor's Teaching Excerpts / Notes
6	8-Oct	*Module 3: Measurement* **Reliability** Theory of Reliability Standard Error of Mean; Standard Error of Measurement	Instructor's Notes [Chapter 27, Foundations of Behavioral Research, 4th Edition, Kerlinger.]
7	15-Oct	*Validity* **(Asynchronous Class)** Content Validity & Validation Criterion Validity & Validation Construct Validity & Validation *Class Assignment – Administered*	Chapter 28, Foundations of Behavioral Research, 4th Edition, Kerlinger
8	22-Oct	*Foundations of Survey Research* Foundations of Survey Research Selecting the Survey Method Survey Design	Chapter 7, Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora
9	29-Oct	*Research Design & Application Exercises* Working with survey instruments Designing Survey Instruments *Quiz – 2 Administered*	Instructor's Teaching Notes / Excerpts
10	5-Nov	*Module 4: Research Design* Foundations of Design Research Design and Causality Types of Design	Chapter 8, Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora
		Experimental Design Foundations of Experimental Design Classifying Experimental Designs Signal Enhancing & Noise Reducing Designs	Chapter 9, Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora
11	12-Nov	**Quasi Experimental Design** Categories of Quasi Experimental Designs The Non-Equivalent Groups Design	Chapter 10, Research Methods: The Essential Knowledge Base (p. v). Cengage Learning, Trochim, Donnely, Arora

No	Date	Topic	Reading / Reference Material
		The Regression Discontinuity Design *Application Exercises*	
12	19-Nov	**Module 5: Advanced Concepts in Causal Inference** Multivariate Methods Research Design Issues in the use of methods based on Multiple Regression Discriminant Analysis & Factor Analysis: Threats to Research Rigor *Class Assignment – Administered*	Chapter 33, Foundations of Behavioral Research, 4th Edition, Kerlinger Chapter 34, Foundations of Behavioral Research, 4th Edition, Kerlinger
		NO CLASS THANKSGIVING	
13	3-Dec	**Review & Recap**	Instructor's Teaching Excerpts
Final Exam December 8 - 15			